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Document No. 62-85009

COOLING APPARATUS OF SPUN YARN

(Boshutsu Shijo no Reikyaku Sochi

Kojitsu Hiroki and Shiro Murakami

UNITED STATES PATENT AND TRADEMARK OFFICE

Washington, D. C. May 2003

Translated by: Schreiber Translations, Inc.

Country	:	Japan
Document No.	:	62-85009
Document Type	:	Kokai
Language	:	Japanese
Inventor(s)	:	Kojitsu Hiroki Shiro Murakami
Applicant	:	Teijin Co., Ltd.
IPC	:	D 01 D 5/092
Date of Filing	:	October 11, 1985
Publication Date	:	April 18, 1987
Foreign Language Title	:	Boshutsu Shijo no Reikyaku Sochi
English Title	:	COOLING APPARATUS OF SPUN YARN

/1[1]

SPECIFICATION

I. Title of the Invention

Cooling Apparatus of Spun Yarn

II. Claims

A cooling apparatus of spun yarn, which is a cooling apparatus for spraying a cooling gas to melt-spun yarns and is characterized by providing

a blowing port of said cooling gas where two or more dispersion bodies consisting of a porous member are arranged inside and outside at an interval and

regulation bodies of a cooling gas blowing length movable up and down along said inner and outer dispersion bodies in close vicinity to the inner and outer dispersion bodies, respectively.

III. Detailed Description of the Invention

This invention relates to a cooling apparatus for spraying a cooling gas to spun yarns of a synthetic fiber and, in more detail, to a variable cooling apparatus which can correspond to a small-scale and multi-brand production.

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[1] Numbers in the margin indicate pagination in the foreign text.

[Prior Art]

Several structures of spinning cylinder which allow spun yarns of a synthetic fiber to be cooled have been embodied so far. For example, a spinning cylinder which contains a supply passage of a cooling gas, is arranged with one or plural porous members coming near to the spun yarns and allowing to rectify and supply the said cooling gas, and optimizes the blowing gas velocity distribution by changing the porosity of said porous members, etc. is given as the most commonly used spinning cylinder. However, such a spinning cylinder had a problem that it could only realize one kind of blowing gas velocity distribution and blowing length and could not be adapted to recent small-scale and multi-brand production. Namely, various corresponding cooling conditions such as quenching, slow cooling, etc. have also increasingly needed with the diversification of quality in recent small-scale and multi-brand production, therefore the prior spinning cylinder or cooling cylinder (cooling apparatus) had such a problem that the correspondence was difficult, and a necessity of replacing a spinning cylinder having an appropriate blowing length and a gas velocity distribution arose every time a brand was changed, thus the productivity was impaired markedly.

A shape made by stacking cooling cylinder parts with a short blowing length in multiple stages, etc. were also given for the purpose of eliminating the drawbacks as described above, but this cooling cylinder also had such problems that the variable region was restricted, the gas velocity distribution in

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connecting portions was not uniform and the equipment cost was sharply increased, etc.

[Purpose of the Invention]

This invention was made with the circumstances described above as background, and its purpose consists in providing a cheap variable spinning cylinder which can change the blowing length and the blowing gas velocity distribution of a cooling gas by one cooling apparatus optionally and quickly and is responsible to small-scale and multi-brand production.

[Constitution of the Invention]

Namely, this invention is a cooling apparatus for spraying a cooling gas to melt-spun yarns and is characterized by providing a blowing port of said cooling gas where two or more dispersion bodies consisting of a porous member are arranged inside and outside at an interval and regulation bodies with a length of blowing part of said cooling gas movable up and down

along said inner and outer dispersion bodies in close vicinity to the inner and outer dispersion bodies, respectively.

[Actual Example]

This invention will be illustrated based on drawings below. Fig. 1 is a sectional view showing an actual example of this invention. In Fig. 1, **1** is a spin block of a melt-spun apparatus and is heated to a certain temperature so as to enclose a spinning pack **2** inside it. A melt polymer which passing inside the spinning block **1** and pressurized/quantified by a spinning pump, etc. passes through the spinning pack **2** and is spun via a spinning mouthpiece **3** to form yarns Y.

The spun yarns are high-temperature and are generally cooled by a cooling apparatus **4** of spinning cylinder arranged immediately under the spinning mouthpiece **3** to control physical properties of yarns such as strength, ductility, etc. The cooling apparatus **4** comprises a main body **5** of cooling apparatus and a variable means **13** of the cooling gas blowing length. The main body **5** is arranged in parallel with an inner dispersion cylinder **6** consisting of porous plates constructing a porous member, an outer dispersion cylinder **7** consisting of a sintered metal and an outer cylinder **8** surrounding the outside of said outer dispersion cylinder **7** at predetermined intervals, and the outer cylinder **8** is so formed that its upper majority narrows to

a cone and so provided that a space between the outer cylinder **8** and the outer dispersion cylinder **7** becomes an equalizing chamber **9**.

An inlet pipe **10** of said cooling gas is connected to the lower part of said outer cylinder **8**, and a dispersion plate **12** formed into a perforated inverted cone is installed in the upper part of an inlet port **11** so as to block the equalizing chamber **9**.

The variable means **13** of the blowing length comprises shielding cylinders **14**, **15** movable up and down along the dispersion cylinders **6**, **7** and a driving mechanism for setting them in motion.

The inner dispersion cylinder **6** is provided by extending it downward longer than the outer dispersion cylinder **7**, and the low ends of the two dispersion cylinder **6**, **7** are fastened to supporting cylinders **6'**, **7'**. **16**, **17** are partition plates holding the supporting cylinders **6'**, **7'**, respectively.

Helical grooves **18**, **19** formed on the outside of said two supporting cylinders **6'**, **7'** at a predetermined pitch, respectively, movable cylinders **20**, **21** having nearly the same length and carved with helical strips **22**, **23** engaged with the grooves **18**, **19** are inserted corresponding to these supporting cylinders **6'**, **7'**, and the shielding cylinders **14**, **15** of

predetermined lengths are installed to the respective movable cylinders **20**, **21**. Vertical grooves are carved over the whole length on the outer periphery of said shielding cylinders **14**, **15** to form spur gears **24**, **25**, pinions **26**, **27** engaged with these spur gears **24**, **25** are installed at the tips of vertically arranged rotary shafts **28**, **29**, and the movable cylinders **20**, **21** are made movable up and down by their rotation.

The rotary shafts **28**, **29** are supported with free rotation via bearings (non-illustrated) provided at the partition plates **16**, **17**, bevel gears **30**, **31** are installed at the lower ends and engaged with bevel gears **34**, **35** provided at the tips of driving shafts **32**, **33** held by non-illustrated brackets with free rotation.

36, **37** are handles installed at the rear ends of said driving shafts **32**, **33**. Moreover, a sealing means is preferably provided in easy-to-leak places such as the rotary shafts, etc. so that the cooling gas does not leak in the cooling apparatus.

The blowing length of cooling gas in such an apparatus, e. g., the blowing length l of said inner dispersion cylinder **6** can be changed if the handle **36** is turned. Usually, it is sufficient that this change is a half or less of the maximum blowing length l, but in such a case that a big change is needed, it had better take a large length of said movable cylinder **20** (movable

cylinder **21** in case of the dispersion cylinder **7**) in accordance with the change, thereby any change is made possible. In this case, it is a big characteristic in this invention that the blowing length l' of the outer dispersion cylinder **7** on the outside is variable.

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Thus, it also becomes possible to change the blowing gas velocity distribution by changing the blowing lengths l, l' of said inner and outer dispersion cylinders **6**, **7**. For example, Figs. 2 - 4 schematically show a relative positional relation of said shielding cylinders **14**, **15**, and Fig. 2 shows the average blowing gas velocity distribution in case that the two shielding cylinders **14**, **15** are make to have same height. Fig. 3 is a case that the shielding cylinder **15** takes a low position and becomes a slow-cooling type blowing gas velocity distribution. Fig. 4 is a case that the shielding cylinder **15** takes a high position and forms a quenching type blowing gas velocity distribution. Thus, the gas velocity distribution becomes changeable in a wide range by combining the two shielding cylinders **14**, **15**. The above are an example of using two shielding cylinders **14**, **15**, but 3 or more shielding cylinders may also be used, and the shielding cylinders can also be combined by taking 3 or more shielding cylinders.

The helical strips **22**, **23** were used as the up-down moving means of said shielding cylinders **14**, **15**, but a means simply based on engagement such as screws, etc., a means based on a fluid pressure cylinder or any other optional means such as rack pinions, etc. may also be used.

The shielding cylinders or movable cylinders are preferably moved up and down by sliding on or closely adhering to the dispersion cylinders or support cylinders, but they may also be shifted in an approached state (said to be "approached" including all of them for convenience). Moreover, the cylindrical cooling apparatus was illustrated in this actual example, of course, this invention is similarly applicable to a case of horizontal blowing cooling apparatus of spun yarns in which a gas is blown to the yarns from one side in the orthogonal direction.

[Effects of the Invention]

As described above, this invention enables to change the cooling gas blowing length and the cooling gas velocity distribution quickly without cutting off the yarns by simple operations even though it has only one cooling gas supply passage for one spinning cylinder as before, this invention is essential to a spinning machine corresponding to small-scale and multi-brand production and also enables to markedly improve the

efficiency of spinning process viewing in the aspect of productivity.

IV. Brief Description of the Invention

Fig. 1 is sectional view showing one actual example of this invention, Fig. 2, Fig. 3 and Fig. 4 are illustrative diagrams schematically showing blowing gas velocity distributions obtained by spinning cylinder of actual example of Fig. 1 in accordance with relative positional relation of two shielding cylinders.

4 ..... cooling apparatus

5 ..... main body

6 ..... inner dispersion cylinder

7 ..... outer dispersion cylinder

8 ..... outer cylinder

13 ..... variable means

14, 15 ..... shielding cylinders

20, 21 ..... movable cylinders

36, 37 ..... handles

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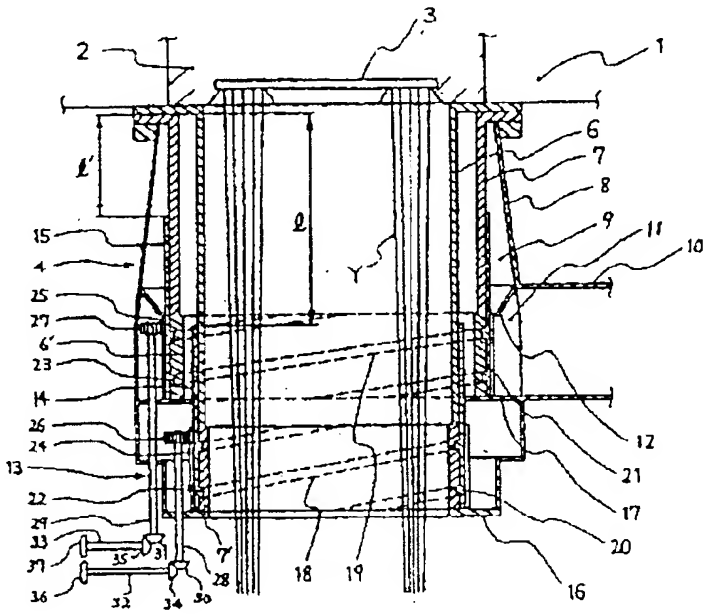
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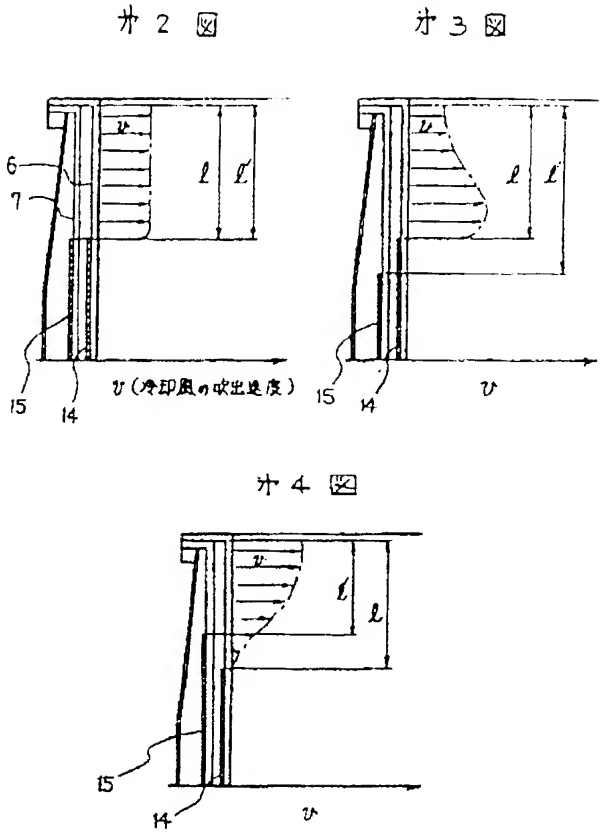

Figure 2: υ (blowing velocity of cooling gas)